

IN THE CLAIMS:

Please amend the claims as follows:

Claim 1 (Canceled).

Claim 2 (Currently Amended): A laser processing method for irradiating an object to be processed with a first laser beam while converging the first laser beam with a lens such that a converging point is positioned within the object, and forming a modified region within the object along a cutting line, the method comprising:

a height acquiring step of irradiating the object with a second laser beam for measuring height of a main surface of the object in an optical axis direction of the lens while converging the second laser beam with the lens, and acquiring the height of the main surface along the cutting line ~~while by detecting reflected light reflected by the main surface in response to the irradiation of the object with the second laser beam; and~~

a processing step of emitting the first laser beam and moving the lens and the object relative to each other ~~along the main surface~~ in a perpendicular direction to the optical axis direction of the lens while adjusting a gap distance between the lens and the main surface according to the acquired height, so as to form the modified region along the cutting line in a predetermined depth relative to the main surface of the object;

wherein the height of ~~the main surface along the cutting line~~ is acquired ~~acquiring step is performed~~ at a first time interval while moving the lens and the object relative to each other at a

first speed along the main surface in the perpendicular direction to the optical axis direction of the lens height-acquiring step; and

wherein the processing step is performed at a second time interval shorter than the first time interval~~modified region is formed~~ while moving the lens and the object relative to each other at a second speed faster than the first speed in the perpendicular direction to the optical axis direction of the lens~~along the main surface and adjusting the gap between the lens and the main surface at a second time interval shorter than the first time interval in the processing step.~~

Claim 3 (Previously Presented): A laser processing method for irradiating an object to be processed with a first laser beam while converging the first laser beam with a lens such that a converging point is positioned within the object, and forming a modified region within the object along a cutting line, the method comprising:

a height acquiring step of irradiating the object with a second laser beam for measuring height of a main surface of the object in an optical axis direction of the lens while converging the second laser beam with the lens, and acquiring the height of the main surface along the cutting line ~~while by~~ detecting reflected light reflected by the main surface in response to the irradiation of the object with the second laser beam; and

a processing step of emitting the first laser beam and moving the lens and the object relative to each other in a perpendicular direction to the optical axis direction of the lens along the main surface while adjusting a gap distance between the lens and the main surface in the optical axis direction of the lens according to the acquired height, so as to form the modified region along the cutting line in a predetermined depth relative to the main surface of the object;

wherein the height acquiring step comprises:

a measurement preparatory step of holding the lens at a measurement initial position set such that a converging point of the second laser beam is located at a predetermined position with respect to the object;

a step of starting emitting of the second laser beam while holding the lens at the measurement initial position, moving the lens and the object relative to each other in the perpendicular direction to the optical axis direction of the lens~~along the main surface, and by releasing the lens from being held at the measurement initial position in response to reflected light of the second laser beam reflected by the main surface; and~~

a step of adjusting the gap distance between the lens and the main surface after the ~~releasesaid releasing while~~by detecting the reflected light of the second laser beam reflected by the main surface, so as to acquire the height of the main surface along the cutting line.

Claim 4 (Currently Amended): A laser processing method for irradiating an object to be processed with a first laser beam while converging the first laser beam with a lens such that a converging point is positioned within the object, and forming a modified region within the object along a cutting line, the method comprising:

a height acquiring step of irradiating the object with a second laser beam for measuring height of a main surface of the object in an optical axis direction of the lens while converging the second laser beam with the lens, and acquiring the height of the main surface along the cutting line ~~while~~by detecting reflected light reflected by the main surface in response to the irradiation of the object by the second laser beam; and

a processing step of emitting the first laser beam and moving the lens and the object relative to each other in a perpendicular direction to the optical axis direction of the lens along the main surface while adjusting a gap distance between the lens and the main surface in the optical axis direction of the lens according to the acquired height, so as to form the modified region along the cutting line in a predetermined depth relative to the main surface of the object;

wherein the processing step comprises:

a processing preparatory step of setting a processing initial position for holding the lens with respect to the main surface according to the height of the main surface along the cutting line acquired by the height acquiring step, ~~and holding the lens at thus set processing initial position~~ so that the converging point is positioned at the predetermined depth under the main surface;

a first processing step of starting emitting ~~of the~~ first laser beam while holding the lens at the processing initial position, and moving the lens and the object relative to each other in the perpendicular direction to the optical axis direction of the lens so as to form the modified region in one end part of the cutting line in the predetermined depth relative to the main surface of the object; and

a second processing step of releasing the lens from ~~being held at the~~ processing initial position after forming the modified region in the one end part of the cutting line, and moving the lens and the object relative to each other ~~after the releasesaid releasing~~ while adjusting the gap distance between the lens and the main surface according to the height of the main surface along the cutting line acquired in the height acquiring step, so as to form the modified region.

Claim 5 (Previously Presented): A laser processing method according to any one of claims 2 to 4, wherein, in the height acquiring step, the first laser beam is emitted when acquiring the height of the main surface along the cutting line, so as to form the modified region along the cutting line.

Claim 6 (Previously Presented): A laser processing method according to claim 5, wherein the modified region formed in the height acquiring step is formed between the modified region formed in the processing step and the main surface.

Claim 7 (Previously Presented): A laser processing method according to any one of claims 2 to 4, wherein cutting the line includes first and second cutting lines;

wherein the height acquiring step moves the lens relative to the object in a first direction extending along the first cutting line, so as to acquire the height of the main surface along the first cutting line, and then moves the lens relative to the object in a second direction opposite from the first direction, so as to acquire the height of the main surface along the second cutting line; and

wherein the processing step forms the modified region along the first cutting line in the first direction, and then forms the modified region along the second cutting line in the second direction.

Claim 8 (Canceled).

Claim 9 (Currently Amended): A laser processing apparatus for irradiating an object to be processed with a first laser beam while converging the first laser beam with a lens such that a converging point is positioned within the object, and forming a modified region within the object along a cutting line, the apparatus comprising:

a lens for converging the first laser beam and a second laser beam toward the object for measuring height of a main surface of the object in an optical axis direction of the lens;

height acquiring means for acquiring the height of the main surface of the object by detecting reflected light reflected by the main surface in response to irradiation of the object with the second laser beam;

moving means for moving the object and the lens relative to each other in a perpendicular direction to the optical axis direction of the lens ~~along the main surface of the object~~;

holding means for holding the lens such that the lens freely advances and retracts with respect to the main surface in the optical axis direction of the lens; and

control means for controlling respective behaviors of the moving means and holding means;

wherein, while the second laser beam is being emitted, the control means controls the moving means so as to move the object and the lens relative to each other ~~along the main surface~~ in the perpendicular direction to the optical axis direction of the lens, the height acquiring means acquiring the height of the main surface along the cutting line; and

wherein, while the first laser beam is being emitted, the control means controls the holding means so as to hold the lens while adjusting a ~~gap distance~~ between the lens and the main surface in the optical axis direction of the lens according to the height acquired by the

height acquiring means, and controls the moving means so as to move the lens and the object relative to each other in the perpendicular direction to the optical axis direction of the lens along the main surface, thereby forming so that the modified region is formed in a predetermined depth relative to the main surface of the object;

wherein, while the second laser beam is being emitted, the control means controls the moving means so as to move the object and the lens relative to each other in the perpendicular direction to the optical axis direction of the lens along the main surface at a first speed, ~~the height acquiring means acquiring the height of the main surface along the cutting line at a first time interval;~~ and

wherein, while the first laser beam is being emitted, the control means controls the moving means so as to move the lens and the object relative to each other in the perpendicular direction to the optical axis direction of the lens along the main surface at a second speed faster than the first speed, ~~and controls the holding means so as to adjust the gap between the lens and the main surface at a second time interval shorter than the first time interval.~~

Claim 10 (Currently Amended): A laser processing apparatus for irradiating an object to be processed with a first laser beam while converging the first laser beam with a lens such that a converging point is positioned within the object, and forming a modified region within the object along a cutting line, the apparatus comprising:

a lens for converging the first laser beam and a second laser beam toward the object for measuring height of a main surface of the object in an optical axis direction of the lens;

height acquiring means for acquiring height of the main surface of the object by detecting reflected light reflected by the main surface in response to irradiation of the object with the second laser beam;

moving means for moving the object and the lens relative to each other in a perpendicular direction to the optical axis direction of the lens~~along the main surface of the object;~~

holding means for holding the lens such that the lens freely advances and retracts with respect to the main surface in the optical axis direction of the lens; and

control means for controlling respective behaviors of the moving means and holding means;

wherein, while the second laser beam is being emitted, the control means controls the moving means so as to move the object and the lens relative to each other in the perpendicular direction to the optical axis direction of the lens~~along the main surface~~, the height acquiring means acquiring the height of the main surface along the cutting line; and

wherein, while the first laser beam is being emitted, the control means controls the holding means so as to hold the lens while adjusting a ~~gap~~distance between the lens and the main surface in the optical axis direction of the lens according to the height acquired by the height acquiring means, and controls the moving means so as to move the lens and the object relative to each other in the perpendicular direction to the optical axis direction of the lens~~along the main surface, thereby forming so that~~ the modified region is formed in a predetermined depth relative to the main surface of the object;

wherein the control means controls the holding means so as to hold the lens at a measurement initial position set such that a converging point of the second laser beam is located at a predetermined position with respect to the object;

wherein, while starting the emission of the second laser beam with the lens being held at the measurement initial position, the control means controls the moving means so as to move the lens and the object relative to each other in the perpendicular direction to the optical axis direction of the lens~~along the main surface~~, and controls the holding means so as to release the lens from being held at the measurement initial position in response to the reflected light of the second laser beam reflected by the main surface; and

wherein, after the release, the control means controls the holding means so as to adjust the gap distance between the lens and the main surface while detecting the reflected light of the second laser beam reflected by the main surface, the height acquiring means acquiring the height of the main surface along the cutting line.

Claim 11 (Currently Amended): A laser processing apparatus for irradiating an object to be processed with a first laser beam while converging the first laser beam with a lens such that a converging point is positioned within the object, and forming a modified region within the object along a cutting line, the apparatus comprising:

a lens for converging the first laser beam and a second laser beam toward the object for measuring height of a main surface of the object in an optical axis direction of the lens;

height acquiring means for acquiring height of the main surface of the object by detecting reflected light reflected by the main surface in response to irradiation of the object with the second laser beam;

moving means for moving the object and the lens relative to each other in a perpendicular direction to the optical axis direction of the lens~~along the main surface of the object~~;

holding means for holding the lens such that the lens freely advances and retracts with respect to the main surface in the optical axis direction of the lens; and

control means for controlling respective behaviors of the moving means and holding means;

wherein, while the second laser beam is being emitted, the control means controls the moving means so as to move the object and the lens relative to each other in the perpendicular direction to the optical axis direction of the lens, the height acquiring means acquiring the height of the main surface along the cutting line; and

wherein, while the first laser beam is being emitted, the control means controls the holding means so as to hold the lens while adjusting a gap distance between the lens and the main surface in the optical axis direction of the lens according to the height acquired by the height acquiring means, and controls the moving means so as to move the lens and the object relative to each other in the perpendicular direction to the optical axis direction of the lens~~along the main surface, thereby so that forming~~ the modified region is formed in a predetermined depth relative to the main surface of the object;

wherein the control means controls the holding means so as to set a processing initial position for holding the lens with respect to the main surface according to the height of the main

surface along the cutting line acquired by the height acquiring means, and hold the lens at thus ~~set processing initial position so that the converging point is positioned at the predetermined depth under the main surface;~~

wherein, while starting the emission of the first laser beam with the lens being held at the processing initial position, the control means controls the moving means so as to move the lens and the object relative to each other in the perpendicular direction to the optical axis direction of the lens, thereby forming so as to form the modified region in one end part of the cutting line in the predetermined depth relative to the main surface of the object; and

wherein, after forming the modified region in the one end part, the control means controls the holding means so as to release the lens from ~~being held at~~ the processing initial position and to adjust the gap distance between the lens and the object according to the height of the main surface acquired by the height acquiring means, and controls the moving means so as to move the lens and the object relative to each other in the perpendicular direction to the optical axis direction of the lens, thereby forming the modified region.

Claim 12 (Previously Presented): A laser processing apparatus according to any one of claims 9 to 11, wherein the height acquiring means emits the first laser beam when acquiring the height of the main surface, so as to form the modified region along the cutting line.

Claim 13 (Previously Presented): A laser processing apparatus according to claim 12, wherein the moving means is adapted to move the object toward the lens; and

wherein the control means controls the moving means such that the modified region formed along the cutting line when the height acquiring means acquires the height is formed between the modified region formed later along the cutting line and the main surface.

Claim 14 (Previously Presented): A laser processing apparatus according to any one of claims 9 to 11, wherein the cutting line includes first and second cutting lines;

wherein the control means controls the moving means so as to move the lens relative to the object in a first direction along the first cutting line, while the height acquiring means acquires the height of the main surface along the first cutting line, and then the control means controls the moving means such that the lens moves relative to the object in a second direction opposite from the first direction, while the height acquiring means acquires the height of the main surface along the second cutting line; and

wherein, after forming the modified region along the first cutting line in the first direction, the control means controls the moving means so as to form the modified region along the second cutting line in the second direction.

Claim 15 (Previously Presented): A laser processing method according to claim 3, wherein the lens is held at the measurement initial position between a position corresponding to one end of the cutting line and a position corresponding to a position on the outside of the one end on an extension of the cutting line, and between a position corresponding to the other end of the cutting line and a position corresponding to a position on the outside of the other end on the extension of the cutting line.

Claim 16 (Currently Amended): A laser processing method according to claim 3, wherein the processing step comprises:

a processing preparatory step of setting a processing initial position for holding the lens with respect to the main surface according to the height of the main surface along the cutting line acquired by the height acquiring step, and holding the lens at thus set processing initial position;

a first processing step of starting emitting of the first laser beam while holding the lens at the processing initial position, and moving the lens and the object relative to each other in the perpendicular direction to the optical axis direction of the lens so as to form the modified region in the one end part of the cutting line; and

a second processing step of releasing the lens from ~~being held at~~ the processing initial position after forming the modified region in the one end part of the cutting line, and moving the lens and the object relative to each other in the perpendicular direction to the optical axis direction of the lens after the release while adjusting the gap distance between the lens and the main surface according to the height of the main surface along the cutting line acquired in the height acquiring step, so as to form the modified region in the predetermined depth relative to the main surface of the object.

Claim 17 (Previously Presented): A laser processing method according to claim 16, wherein the cutting line includes first and second cutting lines;

wherein the height acquiring step moves the lens relative to the object in a first direction extending along the first cutting line, so as to acquire the height of the main surface along the

first cutting line, and then moves the lens relative to the object in a second direction opposite from the first direction, so as to acquire the height of the main surface along the second cutting line; and

wherein the processing step forms the modified region along the first cutting line in the first direction, and then forms the modified region along the second cutting line in the second direction.

Claim 18 (Previously Presented): A laser processing method according to claim 3 or 4, wherein the cutting line includes first and second cutting lines;

wherein the height acquiring step moves the lens relative to the object in a first direction extending along the first cutting line, so as to acquire the height of the main surface along the first cutting line, and then moves the lens relative to the object in a second direction opposite from the first direction, so as to acquire the height of the main surface along the second cutting line; and

wherein the processing step forms the modified region along the first cutting line in the first direction, and then forms the modified region along the second cutting line in the second direction.

Claim 19 (Previously Presented): A laser processing apparatus according to claim 10, wherein the lens is held at the measurement initial position between a position corresponding to one end of the cutting line and a position corresponding to a position on the outside of the one end on an extension of the cutting line, and between a position corresponding to the other end of

the cutting line and a position corresponding to a position on the outside of the other end on the extension of the cutting line.

Claim 20 (Currently Amended): A laser processing apparatus according to claim 10, wherein the control means controls the holding means so as to set a processing initial position for holding the lens with respect to the main surface according to the height of the main surface along the cutting line acquired by the height acquiring means, and hold the lens at thus set processing initial position;

wherein, while starting the emission on the first laser beam with the lens being held at the processing initial position, the control means controls the moving means so as to move the lens and the object relative to each other in the perpendicular direction to the optical axis direction of the lens, thereby forming the modified region in one end part of the cutting line; and

wherein, after forming the modified region in the one end part, the control means controls the holding means so as to release the lens from ~~being held at~~ the processing initial position and adjust the gap distance between the lens and the main surface of the object according to the height of the main surface acquired by the height acquiring means, and controls the moving means so as to move the lens and object relative to each other in the perpendicular direction to the optical axis direction of the lens, thereby forming the modified region.

Claim 21 (Previously Presented): A laser processing apparatus according to claim 20, wherein the cutting line includes first and second cutting lines;

wherein the control means controls the moving means so as to move the lens relative to the object in a first direction along the first cutting line, while the height acquiring means acquires the height of the main surface along the first cutting line, and then the control means controls the moving means such that the lens moves relative to the object in a second direction opposite from the first direction, while the height acquiring means acquires the height of the main surface along the second cutting line; and

wherein, after forming the modified region along the first cutting line in the first direction, the control means controls the moving means so as to form the modified region along the second cutting line in the second direction.

Claim 22 (Previously Presented): A laser processing apparatus according to claim 10 or 11, wherein the cutting line includes first and second cutting lines;

wherein the control means controls the moving means so as to move the lens relative to the object in a first direction along the first cutting line, while the height acquiring means acquires the height of the main surface along the first cutting line, and then control means controls the moving means such that the lens moves relative to the object in a second direction opposite from the first direction, while the height acquiring means acquires the height of the main surface along the second cutting line; and

wherein, after forming the modified region along the first cutting line in the first direction, the control means controls the moving means so as to form the modified region along the second cutting line in the second direction.

Claim 23 (Currently Amended): A laser processing method according to claim 2,
wherein the ~~displacement height~~ acquiring step comprises:

a measurement preparatory step of holding the lens at a measurement initial position set such that a converging point of the second laser beam is located at a predetermined position with respect to the object;

a first measurement step of starting emitting the second laser beam while holding the lens at the measurement initial position, moving the lens and the object relative to each other in the perpendicular direction to the optical axis direction of the lens~~along the main surface~~, and releasing the lens from ~~being held at~~ the measurement initial position in response to reflected light of the second laser beam reflected by the main surface; and

a second measurement step of adjusting the gap distance between the lens and the main surface after the release while detecting the reflected light of the second laser beam reflected by the main surface, so as to acquire the ~~displacement height~~ of the main surface along the ~~line to~~ cutting line.

Claim 24 (Currently Amended): A laser processing method according to claim 23,
wherein the processing step comprises:

a processing preparatory step of setting a processing initial position for holding the lens with respect to the main surface according to the ~~displacement height~~ of the main surface along the ~~line to~~ cutting line acquired by the ~~displacement height~~ acquiring step, and holding the lens at thus set processing initial position;

a first processing step of starting emitting the first laser beam while holding the lens at the processing initial position, and moving the lens and the object relative to each other in the perpendicular direction to the optical axis direction of the lens so as to form the modified region in one end part of the ~~line to~~ cutting line; and

a second processing step of releasing the lens from ~~being held at~~ the processing initial position after forming the modified region in the one end part of the ~~line to~~ cutting line, and moving the lens and the object relative to each other in the perpendicular direction to the optical axis direction of the lens after the release while adjusting the ~~gap~~ distance between the lens and the main surface according to the ~~displacement~~ height of the main surface along the ~~line to~~ cutting line acquired in the ~~displacement~~ height acquiring step, so as to form the modified region.

Claim 25 (Currently Amended): A laser processing apparatus according to claim 9, wherein the control means controls the holding means so as to hold the lens at a measurement initial position set such that a converging point of the second laser beam is located at a predetermined position with respect to the object;

wherein, while starting the emission of the second laser beam with the lens being held at the measurement initial position, the control means controls the moving means so as to move the lens and the object relative to each other in the perpendicular direction to the optical axis direction of the lens ~~along the main surface~~, and controls the holding means so as to release the lens from ~~being held at~~ the measurement initial position in response to the reflected light of the second laser beam reflected by the main surface; and

wherein, after the release, the control means controls the holding means so as to adjust the gap distance between the lens and the main surface while detecting the reflected light of the second laser beam reflected by the main surface, the displacement height acquiring means acquiring the height displacement of the main surface along the line-to-cutting line.

Claim 26 (Currently Amended): A laser processing apparatus according to claim 25, wherein the control means controls the holding means so as to set a processing initial position for holding the lens with respect to the main surface according to the displacement height of the main surface along the line-to-cutting line acquired by the displacement height acquiring means, and hold the lens at thus set processing initial position;

wherein, while starting the emission of the first laser beam with the lens being held at the processing initial position, the control means controls the moving means so as to move the lens and the object relative to each other in the perpendicular direction to the optical axis direction of the lens, thereby forming the modified region in one end part of the line-to-cutting line; and

wherein, after forming the modified region in the one end part, the control means controls the holding means so as to release the lens from ~~being held at the~~ processing initial position and adjust the gap distance between the lens and the object according to the displacement height of the main surface acquired by the displacement height acquiring means, and controls the moving means so as to move the lens and the object relative to each other, thereby forming the modified region.